



FAME Observatory Contamination Control

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Scope of Contamination Control Efforts



- Requirements Identification
 - Review, Understand, Analyze Instrument Requirements
 - Contribute to the Contamination Section of Spacecraft to Instrument ICD
 - Develop Observatory Processing Method
 - Maintain Instrument Cleanliness
 - Maximize Ease of Spacecraft Access
- Provide Program Guidance
 - Material Selection
 - Bakeout Procedures
 - System Processing
 - Material and Process Waivers
- Maintain Instrument/Observatory Cleanliness
 - Implement Procedures
 - Spacecraft Processing
 - Instrument Purge/Bagging
 - Test/Verify Surfaces
 - Clean Surfaces (As Required)



Requirements



- **Ensure Proper Techniques and Methods Are Used in Subsystem Development for Contamination Mitigation**
- **Maintain Instrument Cleanliness**
- **Process Observatory in a “Controlled Environment”**
 - **Typically a Class 10,000 or Better Location**
 - **Occasional Class 100,000 - 300,000 Facility**
 - **Crane Operations**
 - **Environmental (Vibration, Acoustic, TVAC) Testing**
 - **Mass Properties**



Contamination Control Design



- **Integral Instrument Purge**
 - **Purge Flow Sufficiently High to Maintain Class 100 or Better Environment**
 - **Opt 1: Class 100 Requires 250 Air Changes an Hour (Impractically High)**
 - **Opt 2: Magnehelic Measurement to Keep Instrument Internal Pressure 0.2 Psi Higher Than External Pressure**
 - **Soln: 24-30 Air Changes an Hour With Restricted Vents Will Achieve +0.2 PSI**
 - **Design Air Flow to Travel From Most Sensitive (FPA) to Least Sensitive (Baffle) Elements**
- **Baffle Design to Eliminate Spacecraft Field of View**
 - **Re-Encounter Rates Are Exceedingly Low**
 - **Less Than 1 Part in 10^6 for Molecular Elements**
- **Baffle Covers**
- **Establishment of Micro-Environments**
 - **Develop an Environmental Cleanliness Contour Around the Instrument**
 - **Maintain Cleanest Environments Nearest to Instrument**
 - **Key Issue Is the Flow of "Clean" Air Over the Instrument**
 - **A Downstream Polluter Will Not Effect the Upstream Environment**
 - **Vertical Laminar Airflow Tent**
 - **Appropriate Gowning Requirements**



Contamination Control Elements



- **NCST-ICD-FM001 Spacecraft Bus to Instrument Interface Control Document (ICD)**
- **NCST-D-FM007, *FAME Contamination Control Plan - 4 Elements***
 - Materials Selection
 - Instrument/Subsystem Design and Development
 - Observatory Integration and Test
 - Launch Site Operations
- **Instrument Contamination Control Plan, P546614**
- **Ancillary Documents**
 - Bakeout Procedure
 - Cleanliness Testing Methods and Procedures
 - Spacecraft Cleaning Procedure
- **Surface Cleanliness Verification**
 - Tape Lifts, Witness Plates, Alcohol Rinse, Visual Inspections
- **Common Sense**
 - Get Scientists, Engineers, and Technicians to Agree to Common Effort
 - Training to Understand Concerns
 - Think and Act . . . Do Not Push Limits of Procedural Rules



Observatory Contamination Control



- **Keep Instrument Bagged at All Times Except TVAC**
- **Maintain GN2 Purge on Instrument Until Launch**
 - **Very Few Disconnections Are Anticipated**
- **Minimize the Number of Times the Instrument Aperture Doors Are Opened**
- **Precondition the TVAC Chamber Prior to Test, and Monitoring Outgassing With TCQM & RGA**
- **Maintain Instrument and Observatory in Cleanest Possible Environment (Cleanroom)**
 - **Ensure Personnel Training and Adherence to Procedures**
- **Bus Contamination Control Methods**



Bus Contamination Control



- **FAME Bus Structure Built Under Normal High Bay Conditions**
 - Interfaces Wiped Down With Solvent and Lint Free Wipes Before Assembly
 - Harness Is Separately Baked Out (Higher Temperature Possible)
- **Structure Is Cleaned Prior to Entering Clean Room for Propulsion System Integration**
- **Following RCS Integration, Structure Leaves Clean Room and Is Placed in Clean Tent in High Bay for Subsystem Integration**
- **After Subsystem Integration, Bus Is Baked Out in Vacuum Chamber**
 - Maintained Until TQCM Indicates Acceptable Outgassing Rate
- **Bus Leaves Chamber and Returns to Clean Room (or Clean Tent)**
- **Instrument and Bus Must Leave Clean Room for Physical Installation**
 - Do Not Have Crane in Any of NRL's Clean Rooms
 - Instrument Is Bagged and Purged, Bus Is Covered With Llumalloy
- **Observatory Is Returned to Clean Room for Electrical Integration**



Bldg A59 Clean Room Facilities

Facility	Best Cleanliness Level	Interior Size (L x W x H)	Entrance Size (W x H)
New Clean Room	Class 1000	44' x 23.7' x 20'	18' x 18'
Old Clean Room	Class 100*	35' x 29' x 10.5'	12' x 9.8'
Fixed Clean Tent	Class 100	17' x 17' x 18'	16' x 9'
Large Portable Clean Tent	Class 100	15' x 15' x 21'	15' x 20'
Small Portable Clean Tent	Class 1000	12' x 6' x 8'	12' x 7.5'

*Horizontal Flow Clean Room, Rating Applies Directly in Front of Filter Bank Only

FAME Observatory Dimensions:

- Height = 8.0 Feet (on Dolly)
- Diameter = 9.0 Feet



Backup

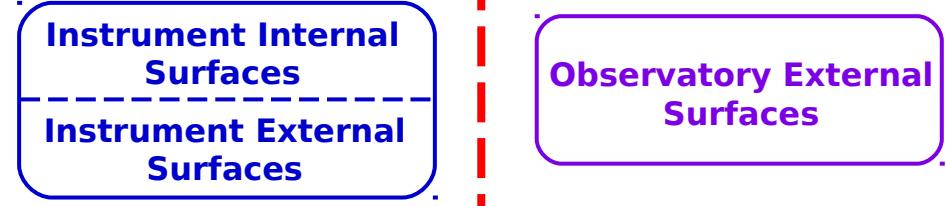


Preliminary Design Description

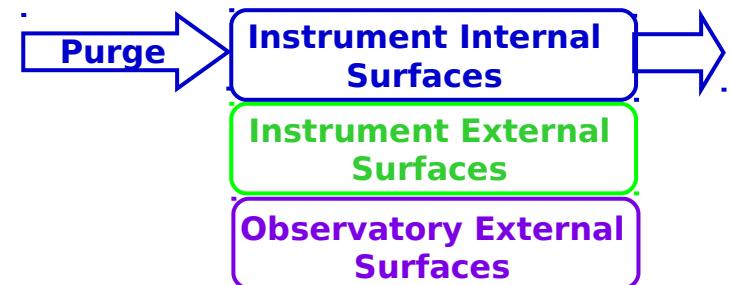


- **Goal:** Maintain Optic Performance
- **Heritage:** All Spacecraft Surfaces Do Not Need to Have the Same Cleanliness Level Provided They Do Not Directly View Each Other
- **Process:**
 - Maintain Identical Internal and External Instrument Surfaces During Instrument Development
 - Upon Observatory I&T, Instrument Purge Maintains Optic Cleanliness
 - Double Bagging Minimizes Contaminant Buildup on External Surfaces
 - Final Cleaning at Launch Site Processing Facility and Pad Close-Out
 - Minimize Surface Class Differential at Launch, Maximize Program Resources

Instrument and Bus Development



Observatory Integration and Test



Launch Preparations and Closeout

